Annual Report:

PYGMY RABBIT MONITORING IN THE PINEDALE ANTICLINE PROJECT AREA, SUBLETTE COUNTY, WYOMING

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ABSTRACT

The pygmy rabbit (*Brachylagus idahoensis*) is a sagebrush-obligate species with a patchy and poorly understood distribution in Wyoming. Because of their dependence on dense patches of sagebrush and soils capable of supporting burrows, concern exists over how pygmy rabbits might be affected by oil and gas development in the Pinedale Anticline Project Area (PAPA) in Sublette County, Wyoming. The Pinedale Anticline Project Office (PAPO) is committed to developing an effective monitoring program to determine if energy development in the PAPA is impacting local pygmy rabbit populations. In May of 2009, the PAPO hired the Wyoming Natural Diversity Database (WYNDD) to survey for pygmy rabbits across the PAPA (treatment) and neighboring Boulder (reference) areas. We detected evidence of current or recent occupancy by pygmy rabbits at 83% of 444 plots surveyed in the two study areas. The Boulder area contained a greater proportion of active plots than the PAPA (81% and 54%, respectively) and a greater proportion of active burrows/plot than the PAPA. The cause of this difference, however, is unclear. Locations where pygmy rabbits were previously documented were largely still active (82%), despite many of these previously known locations occurring within the oil and gas development zone in the PAPA. However, the proportion of active burrows/plot was greater outside of the oil and gas development zone. Development of an effective monitoring program is necessary to investigate pygmy rabbit population trends and to determine if disturbances related to oil and gas development might affect pygmy rabbit populations in the PAPA.

INTRODUCTION

The pygmy rabbit (*Brachylagus idahoensis*) is the smallest rabbit in North America and is the only extant member of the genus *Brachylagus*. The pygmy rabbit is a sagebrush-obligate species with a patchy and poorly understood distribution throughout the species' range, which includes the Great Basin and surrounding intermountain areas. Prior to the late 1990's, little was known about pygmy rabbits. Following the dramatic decline and subsequent listing of the Columbia Basin Distinct Population Segment of the pygmy rabbit in Washington (Federal Register 2003), however, concern about the status of pygmy rabbit population throughout the species' range led to an increase in survey efforts as well as scientific studies of pygmy rabbit behavior and habitat requirements.

In Wyoming, the pygmy rabbit is listed as a sensitive species with the Wyoming Bureau of Land Management (BLM), largely due to the species' low density, patchy distribution, and sensitivity to sagebrush fragmentation. Pygmy rabbits require areas of relatively dense sagebrush (*Artemisia tridentata* spp.) and deep soils capable of supporting burrows. Unlike cottontails (*Sylvilagus* spp.), pygmy rabbits dig their own burrows and are highly dependent upon burrows for protection. Research suggests that sagebrush destruction and fragmentation restricts pygmy rabbit dispersal and increases vulnerability to predation (Bradfield 1974, Engeman et al. 2002, Keinath and McGee 2004). However, pygmy rabbits are capable of moving large distances (up to 12km) across relatively contiguous sagebrush habitat and have been documented to cross secondary gravel roads and rural highways (Sanchez 2007, Estes-Zumpf and Rachlow 2009). Thus, the influence of disturbance in sagebrush landscapes on pygmy rabbit populations is difficult to predict.

As lands administered by the Pinedale Field Office (FO) of the BLM continue to undergo expansion of infrastructure associated with oil and gas development, potential impacts to pygmy rabbits rise correspondingly. Currently, however, little empirical information exists about the potential effects of energy development on pygmy rabbits. Because of the species' sensitive status and concerns over potential impacts of energy development to pygmy rabbits, the 2008 Record of Decision (ROD) for the Pinedale Anticline Oil and Gas Exploration and Development Project in Sublette County, Wyoming, requires monitoring of pygmy rabbit populations in the Pinedale Anticline Project Area (PAPA). Monitoring populations in the PAPA and adjacent Boulder reference area will allow the Pinedale Anticline Project Office (PAPO) to identify potential impacts of energy development on pygmy rabbits and guide adaptive management and mitigation measures.

In May 2009, the PAPO contracted the Wyoming Natural Diversity Database (WYNDD) to conduct comprehensive surveys for pygmy rabbits in the PAPA and neighboring Boulder reference area. WYNDD, a service and research unit of the University of Wyoming, is dedicated to the collection and dissemination of unbiased data on the biology of sensitive species in Wyoming so that organizations can make informed and effective management decisions. In keeping with our mission, WYNDD surveyed for pygmy rabbits and mapped pygmy rabbit presence/absence in the PAPA and Boulder study areas. We also examined patterns of pygmy rabbit presence/absence in relation to energy development infrastructure.

Overall Project Goals and Objectives:

The ultimate goal of this project is to quantitatively report and map the distribution of pygmy rabbits in the PAPA and Boulder study areas, and to establish and execute an effective monitoring program capable of detecting the level of change in distribution or abundance described by the Pinedale Anticline ROD Wildlife Monitoring and Mitigation Matrix. This matrix requires monitoring programs to be able to detect 3 consecutive years of decline in presence or absence of a species or an average of 15% decline in numbers of individuals each year over 3 years. The specific objectives that will be used to meet these goals are to:

1. Identify pygmy rabbit burrows on public land within the PAPA (treatment) and Boulder (reference) areas,
2. Monitor burrows for presence/absence,
3. Report change in population numbers or active burrows.

Goals and Objectives for 2009 Field Season:

This particular project was initiated as a 1-year contract (with opportunity for renewal) to begin mapping the distribution of pygmy rabbits across the study areas via extensive survey efforts. The goals of this project were to quantitatively report and map the distribution of pygmy rabbits across the PAPA and Boulder study areas and to identify any changes in distribution or numbers already apparent from past records of rabbit occurrence. The specific objectives that will be used to meet these goals are to:

1. Identify pygmy rabbit burrows on public land within the PAPA (treatment) and Boulder (reference) areas,
2. Determine if the Boulder study area contains pygmy rabbits and is a suitable reference area for future comparisons with the PAPA,
3. Determine if locations previously known to contain pygmy rabbits are still occupied by pygmy rabbits,
4. Determine if pygmy rabbit presence differs in the PAPA between plots located within and outside oil development areas.

METHODS

Study Area

According to the 2009 PAPO Request For Quote (RFQ), the first year (2009) of the project would focus on surveying for and mapping presence of pygmy rabbit burrows and evidence of pygmy rabbits (e.g., pellets, visual observations) in the PAPA (treatment) and Boulder (reference) study areas (Figure 1). The PAPA is an 80,143-hectare area managed by the BLM Pinedale FO, the state, and private landowners. The area is comprised of sagebrush-steppe vegetation. Sagebrush (*Artemesia* spp.) is the dominant shrub throughout most of the PAPA, however, sagebrush density varies across the PAPA likely due to soil type, topography, and both historic and current disturbances. The most prominent landscape feature is a large mesa that runs

roughly north-south through the northern half of the PAPA. The PAPA is managed by the BLM for multiple uses, including oil and gas development, cattle grazing, recreation, and hunting, and also serves as critical wintering grounds for several game species. Pygmy rabbits are known to occur in some areas of the PAPA, however, their distribution and status throughout the PAPA is largely unknown. Elevation in the PAPA ranges from approximately 2090m to 2360m.

The Boulder study area is a 17,009-hectare area managed by the BLM Pinedale FO and was established as the reference area for this study due its lack of energy development and its similarity of vegetation communities to the PAPA. The Boulder study area also is characterized by sagebrush-steppe vegetation. Sagebrush is the dominant shrub and, as in the PAPA, density of sagebrush varies across the study area. The northern end of the Boulder study area contains several large outcroppings of granite boulders. The southern end of the study area tends to be relatively flat and intermixed with large expanses of sandy soils often dominated by rabbitbrush (*Chrysothamnus* and *Ericameria* spp.) and grasslands. Few records of pygmy rabbits exist from the Boulder study area, however, habitat appears relatively similar to the PAPA. Elevation in the Boulder study area ranges from approximately 2190m to 2370m.

Study Design

The study design for 2009 followed the methodology outlined in the RFQ and targeted random plots provided by the BLM as well as locations of previous pygmy rabbit sightings. Many previous pygmy rabbit sightings occurred during clearance surveys related to oil and gas development and, thus, potentially can be viewed as 'baseline' rabbit presence data in areas undergoing extensive energy development. Survey plots (400m x 400m) covered 16 hectares and were designated by the following rules:

<u>Random Plots:</u>

- Two plots per section were randomly chosen in both the PAPA and Boulder study area.
- Points for the southwest corner of each plot were randomly generated by the BLM (Supplemental Data A).
- Total number of random plots = 733 (Appendix A)

<u>Known Rabbit Locations:</u>

- Surveyors returned to locations where pygmy rabbits had been seen in the PAPA and Boulder study area. Known locations were provided by the BLM (Supplemental Data B&C).
- Surveys also returned to burrows where fresh pellets were found during BLM pygmy rabbit surveys led by Dale Woolwine (Supplemental Data D).
- Surveyors established 400m x 400m plots surrounding known locations or encompassing clusters of known locations.
- Plots were surveyed to determine the current status of burrows and to detect and record activity at all rabbit burrows within the plot following approved BLM protocols (Appendix B).

- Total number of known plots = 124 (Appendix A)

Survey Protocol

Survey methods followed approved BLM pygmy rabbit survey protocols (Appendix B) outlined in the initial RFQ. Deviations to the BLM protocol, such as no photo documentation of burrows and no pellet sample collection, were discussed in June 2009 and were agreed upon by all parties involved. In addition to the approved BLM pygmy rabbit survey protocol, field technicians also recorded burrow activity status (active, recent, old, very old) based on burrow condition and presence of sign (pellets, digging) outlined in Appendix C. This simple yet promising index of activity has successfully been used to track changes in rabbit numbers and shifts in rabbit distributions across time in the Lemhi Valley, Idaho (Dr. Janet Rachlow, University of Idaho, *personal communication*).

Field technicians used Garmin GPSmap 76S units to navigate to the southwest corner of each random plot. Coordinates of the plot were adjusted if the 400m x 400m plot would overlap with oil platforms or other survey plots or if the plot would extend beyond the study area border or encompass large expanses of non-habitat (no sagebrush present). Because pygmy rabbits can occupy areas of steep topographic relief as well as areas with rock outcroppings, plots were not relocated due to presence of these landscape features. For plots at known pygmy rabbit locations, field technicians navigated to the known point(s) and established a 400m x 400m plot around the known location, which included that location and surrounding pygmy rabbit habitat. Because many known locations were clustered across the landscape, known plots frequently included multiple known points.

Survey plots consisted of nine linear transects running in a north-south direction. Transects were spaced 50m apart, resulting in eight 50m belt transects (see page 2 of sample datasheet, Appendix D). Field technicians surveyed all habitat within the eight 50m belt transects spanning the length of the plot, as well as all optimal habitat immediately adjacent to the plot. This method is based on the nine linear transects previously used by the BLM, but results in a more comprehensive search of the plot and surrounding habitat because surveyors are required to cover more ground between the linear transects. Despite the increase in the amount of area surveyed, this method still is not and was not meant to be a complete census of all burrows within a plot.

Plots were typically surveyed by 2 field technicians searching adjoining 50m belt transects. Field technicians recorded data on all burrows or burrow complexes detected that were used by or could have been constructed by pygmy rabbits. Field technicians also recorded any occurrence of fresh or old pygmy rabbit pellets found that did not appear to be associated with burrows. Due to time restrictions, technicians were encouraged to look quickly for nearby burrows when pygmy rabbit pellets were found, but to record the pellet data and continue the survey if no burrows were detected in the immediate vicinity. Thus, observations of pygmy rabbit pellets in the absence of burrows does not necessarily reflect lack of burrow use by pygmy rabbits, but rather curtailed search effort necessary to conform to protocols. All data collection followed BLM protocols and templates outlined in the RFQ (Appendix B) based on Ulmschneider et al. (2004). A sample data sheet is provided in Appendix D.

Training

WYNDD hired 4 summer field technicians to work in teams of 2 to conduct surveys from July through early September. We extended the field season for 2 technicians who continued surveys through early October. All technicians were trained by Dr. Wendy Estes-Zumpf, who has work extensively with pygmy rabbits in the field and is highly skilled at surveying for and locating rabbits, burrows, and pellets under a wide range of habitat condition (topography, vegetation structure, etc.). Technicians were taught to differentiate pygmy rabbit sign (burrows and pellets) from sign left by other species, especially cottontails and ground squirrels. Dr. Estes-Zumpf trained technicians and several agency personnel during a 1-day field training workshop in early July. After initial training, Dr. Estes-Zumpf worked alongside each technician for several days to improve and test technicians' identification skills and to answer questions and review common scenarios in the field. Field technicians were instructed to consider rabbit pellets to be from pygmy rabbits only when sufficient data was present to make the call. If pellets could not be distinguished from other lagomorph species, technicians were instructed to explicitly note that evidence was questionable and to describe the evidence in the "Notes" column of data sheets. Dr. Estes-Zumpf also conducted surveys, working either independently or with technicians, during extended field visits.

Technical Evaluation and Analyses

Technicians collected data on over 5,000 burrow complexes. The activity status of each plot was summarized as follows: 1) plots were considered actively occupied by pygmy rabbits if pygmy rabbits were seen and/or if fresh pygmy rabbit pellets were detected within the plot, 2) plots were considered recently occupied by pygmy rabbits if old pygmy rabbit pellets were detected but no fresh pellets were found and no pygmy rabbits were seen, 3) plots were considered potentially occupied by pygmy rabbits in the past if the plot contained intact burrows that could have been constructed by pygmy rabbits but pygmy rabbit pellets were not detected in the plot, 4) plots were considered likely not used by pygmy rabbits if no pygmy rabbit burrows or pellets were detected during surveys. We recorded the number of pygmy rabbits and relative amount of pellets seen on each plot. We also calculated the total number of burrows detected and the proportion of burrows on each plot that were determined to be active (hereafter referred to as the proportion of active burrow/plot).

Results were compared between the treatment (PAPA) and reference (Boulder) study areas. We also compared results between random and known plots within the entire PAPA, and between random and known plots within the oil and gas development areas highlighted by the BLM. Results were analyzed using ArcGIS 9.2. We tested for differences in the frequency of active plots between study areas and between random and known plots using a Fisher's Exact test. We used a Wilcoxon rank-sums test to compare the number of burrows and the proportion of active burrows/plot between study areas and between random and known plots. For analysis of the development area, we used a shapefile with the boundaries of the 5 oil development areas in PAPA to clip out all plots within the development zone. The development area shapefile was provided by the BLM Pinedale FO. More detailed analyses of potential influences of disturbances on pygmy rabbit populations in the PAPA will follow as detailed data on disturbed areas becomes available.

RESULTS

We surveyed 444 plots covering 470 assigned survey points (390 random, 80 known) and 2 incidental plots. Incidental plots were plots established by field crews and were not based on locations generated by the BLM Pinedale FO. For the purposes of this report, we hereafter consider incidental plots to be random plots. Average length of time necessary to conduct surveys was 1hr 20min. Although this was longer than our initial estimate of time needed to complete each plot, we feel that the added time was necessary to obtain quality, repeatable results that could be used in a long-term monitoring program.

Overall, we found fresh pygmy rabbit pellets and/or pygmy rabbits at 262 plots (59%), and evidence of recent pygmy rabbit activity (burrows with old pygmy rabbit pellets) at an additional 105 plots (24%; Figure 2). Thus, we confirmed current or recent use by pygmy rabbits at 83% of the plots surveyed across the PAPA and Boulder study areas. However, amount of pygmy rabbit pellets and proportion of burrows used by pygmy rabbits varied greatly among plots. In general, frequency of fresh pellets within most active plots was low. Certain plots, however, contained large amounts of fresh and old pellets. Field crews obtained visual confirmation of 120 pygmy rabbits while conducting surveys in the PAPA and Boulder study areas, as well as 4 incidental sightings of pygmy rabbits outside of survey plots (Figure 3). The most pygmy rabbits observed in a plot (6 rabbits) occurred at random plot 261 in the Boulder study area. Two random plots on the eastern edge of the PAPA near the Boulder study area border (plots 166 and 167) also had 5 rabbit sightings each.

Comparisons between study areas

Habitat characteristics, primarily sagebrush density, soil type, and topography, varied across both the PAPA (treatment) and Boulder (reference) areas. In general, the PAPA contained the greatest variation in sagebrush density, ranging from more grassland environments to dense expanses of sagebrush. The PAPA also had more topography (e.g., mesas, deep ravines) than the Boulder area, which was largely comprised of low rolling hills (Figure 1). Although the treatment and reference areas differed somewhat in their range of habitat characteristics, we detected presence of pygmy rabbits in both study areas.

We surveyed 359 plots in the PAPA and 85 plots in the Boulder study area. The Boulder study area contained a greater proportion of active plots (81%) than the PAPA (54%; Table 1; 2-tailed Fisher's Exact test, $P < 0.0001$, $n = 444$). The median number of burrows/plot in the Boulder study area (11 burrows/plot) was greater than that of the PAPA (5 burrows/plot; 2-sample Wilcoxon rank-sums test, $Z = 5.48$, $P < 0.0001$, $n = 444$). The Boulder study area also had a greater proportion of active burrows/plot (median = 0.2) than the PAPA (median = 0.05; 2-sample Wilcoxon rank-sums test, $Z = 3.69$, $P = 0.0002$, $n = 444$). In general, the Boulder reference area tended to have a greater relative proportion of active burrows and a lower proportion of possible old pygmy rabbit burrows than the PAPA (Figure 4a).

Field crews failed to find any evidence of pygmy rabbits (burrows or pellets) at 12% of plots surveyed in the PAPA. These areas tended to be in the southern half of The Mesa in the north-central PAPA, and in the west-central and southern tip of the PAPA (Figure 2). Although pygmy rabbits are commonly found in rocky areas interspersed with sagebrush, we failed to detect pygmy rabbits in several of the large hills of granite boulders at the northeastern edge of the

Boulder study area. Evidence of pygmy rabbits, however, was detected in clumps of sagebrush and in sagebrush-lined drainages surrounding the hills. Evidence of pygmy rabbits was common at smaller rock outcroppings throughout the Boulder study area.

Known vs. Random

We surveyed 52 plots containing 80 locations where pygmy rabbits previously occurred. Only one of the 52 known-location plots surveyed occurred in the Boulder area. All others were located in the PAPA. Thus, we restricted comparisons of known versus random plots to the PAPA (known $n = 51$; random $n = 308$).

Of the 51 plots containing points where pygmy rabbits were previously seen or where active pygmy rabbit burrows were documented in the PAPA during earlier BLM surveys, 42 (82%) were active, 6 (12%) showed evidence of recent pygmy rabbit activity but no evidence of current activity, and only one plot showed no evidence of current or recent pygmy rabbit use (BLM known plot 55). The proportion of known plots that were active (82%) was greater than the proportion of active random plots in the PAPA (49%; Table 1; 2-tailed Fisher's Exact test, $P < 0.0001$, $n = 359$). The median number of burrows/plot at known plots (26 burrows/plot) greatly exceeded the median at random plots (4 burrows/plot; 2-sample Wilcoxon rank-sums test, $Z = 9.59$, $P < 0.0001$, $n = 359$). The proportion of active burrows/plot, however, did not differ between random (median = 0) and known plots (median = 0.06) on the PAPA (2-sample Wilcoxon rank-sums test, $Z = -0.03$, $P = 0.9753$, $n = 301$). In general, random plots tended to have a greater relative proportion of active burrows and a lower proportion of possible old pygmy rabbit burrows than known plots in the PAPA (Figure 4b).

Oil & Gas Development areas

We surveyed 112 plots in the PAPA that occurred in the 5 oil and gas development areas identified by the BLM (Figure 5). Proportion of active (52%) and recently active (25%) plots within the development zone was similar to the proportion of active and recent plots throughout the PAPA (54% and 26% respectively; 2-tailed Fisher's Exact test, $P = 0.82$ for active plots, $P = 0.70$ for recent plots, $n = 359$). However, the proportion of active burrows/plot was lower in the development zone (median = 0.03) than in the rest of the PAPA (median = 0.1; 2-sample Wilcoxon rank-sums test, $Z = -2.82$, $P = 0.0049$, $n = 301$; Figure 4c) despite a greater number of burrows/plot in the development zone (2-sample Wilcoxon rank-sums test, $Z = 3.57$, $P = 0.0004$, $n = 359$).

Thirty-two known plots were surveyed inside the development zone and 19 were surveyed in the remainder of the PAPA. The proportion of known plots within the development zone that were still active (88%) was similar to the proportion of known plots that were active in the rest of the PAPA (74%; 2-tailed Fisher's Exact test, $P = 0.2656$, $n = 51$). Only 2 (6%) previously active known plots within the development area showed evidence of recent but no current pygmy rabbit activity (Table 1). The proportion of active random plots in the PAPA was slightly greater outside the development zone (53%) than inside the development zone (39%; 2-tailed Fisher's Exact test, $P = 0.0377$, $n = 308$).

DISCUSSION

Wyoming is the eastern-most extent of the pygmy rabbit's range in North America, and information on the distribution of pygmy rabbits within the state is limited. Although Wyoming contains vast expanses of sagebrush, occurrences of pygmy rabbits are primarily restricted to the southwest portion of the state. Knowledge of the distribution of pygmy rabbits is complicated by similarities in the size and appearance between pygmy rabbits and juvenile cottontails and between pygmy rabbit pellets and pellets from young cottontails, making identification of pygmy rabbits and their sign difficult in the field. Furthermore, pygmy rabbits are often distributed patchily throughout sagebrush landscapes. Soils likely have a strong influence on the distribution of pygmy rabbits, due to the rabbits' dependence on burrows, however, our understanding of the population dynamics and habitat requirements of pygmy rabbits are still incomplete.

Because our knowledge of the population dynamics and ecology of pygmy rabbits is limited, impacting even our ability to determine basic presence/absence of the species, developing a monitoring program capable of tracking population trends is challenging. Concern over the status of pygmy rabbit populations and an overall lack of information on how disturbance to sagebrush landscapes might impact pygmy rabbit populations, however, make developing an effective monitoring program necessary to identify potential effects of energy development on this species.

The influence of energy development on pygmy rabbit populations in the sagebrush-steppe ecosystem of the Pinedale Anticline is yet unknown. The PAPO is committed to developing and executing a monitoring program capable of detecting impacts of oil development on local pygmy rabbit populations, if such impacts occur. Because very little is known about the current distribution and abundance of pygmy rabbits within the PAPA and neighboring Boulder reference areas, however, a thorough survey of these study areas is necessary before a monitoring program can be implemented.

Using standardized identification training and survey protocols, we documented current and recent occurrence of pygmy rabbits throughout much of the PAPA and Boulder study areas. Both study areas appear to contain substantial amounts of pygmy rabbit habitat. Distribution of pygmy rabbits in both areas, however, was often patchy. Within a survey plot with low sagebrush density, for example, presence of pygmy rabbits might only have been detected in denser sagebrush along a wash, or in a single patch of clustered sagebrush. Even in areas with high sagebrush density or those with clumps of sagebrush on mima mounds (mounded micro-topography) pygmy rabbit presence might only have been detected at a few burrow complexes in one portion of the plot.

Although pygmy rabbits occurred in both study areas, the Boulder area contained a greater proportion of active plots and a greater proportion of active burrows than the PAPA. Because this is the first year of systematic surveys for this project and little previous data exists for pygmy rabbits in the Boulder area, we cannot yet determine the cause for this discrepancy. Factors that might be responsible for the difference in occupancy between study areas include differences in habitat quality, natural population trends or cycles, or differences in past or present disturbances. Continued monitoring of these study areas is necessary to investigate the different occupancy rates.

Although this was the first year of systematic surveys in the PAPA and Boulder areas, pygmy rabbits previously have been documented, primarily in the PAPA. Many of these earlier records come from recent clearance surveys for incoming oil and gas development. By surveying locations where pygmy rabbits were seen in the past, we can at least begin to investigate population trends and potential effects of oil and gas development on pygmy rabbits in the PAPA.

We determined that 82% of plots previously known to contain pygmy rabbits were still active, with either fresh pygmy rabbit pellets or pygmy rabbits themselves detected in the plots. All but one of the known plots were initially surveyed within the past 7 years. Given the short life expectancy of pygmy rabbits (mean = 1.7 years, Sanchez 2007), these results seem to suggest that areas where pygmy rabbits were previously documented continue to be occupied to some extent despite likely turnover of individual rabbits. Many of the previously known locations were documented during clearance surveys and occur in the oil and gas development zone outlined by the BLM. The proportion of known plots that were still active within the development zone was similar to the proportion of active known plots outside the development zone. However, the proportion of active burrows/plot was greater outside the development zone. Although this trend could indicate that the relative abundance of pygmy rabbits/plot is lower in the development zone, pygmy rabbits continue to persist in that area and monitoring of plots is necessary to determine population trends. Comparisons of habitat quality have not been conducted between plots within and outside the development zone and detailed information on the timing and relative amount of disturbance on or near plots is not yet available. These results could, however, indicate that pygmy rabbits can tolerate some types or amounts of disturbance associated with oil and gas development. Systematic monitoring and more detailed analyses of disturbance factors are needed to determine pygmy rabbit population trends for different types and levels of oil and gas development.

One caveat to the widespread distribution of pygmy rabbits documented in the PAPA and Boulder study areas is our limited ability to estimate pygmy rabbit abundance. Individual rabbits typically use multiple burrow complexes and home ranges can vary from approximately 3 to 17 hectares depending on sex, season, and habitat characteristics (Sanchez and Rachlow 2008). Pygmy rabbits generally are solitary, but home ranges often overlap (Sanchez and Rachlow 2008) and rabbit densities can be high in areas of quality habitat or where resources are clumped, such as in drainages and ravines or along washes. Thus, examining patterns and frequencies of active plots, alone, might not accurately depict population trends.

Areas that are sub-optimal for maintaining resident rabbits might still support dispersing rabbits. Pygmy rabbits are capable of dispersing rapidly over 10km and a large proportion of juvenile males and females (90% and 80%, respectively) disperse from their natal areas (Estes-Zumpf and Rachlow 2009). Adult rabbits, especially males, are also known to make rapid long-distance movements (Sanchez 2007). Dispersing rabbits likely cross expanses of sagebrush that are not suitable for establishing residency but provide adequate cover for transitory movements. These areas would likely contain a few fresh pellets, but almost no old pellets, or just a few old pellets from past dispersers. We found approximately 26 plots that met these criteria. Although some dispersal plots were scattered throughout the study areas, most occurred near areas with little evidence of pygmy rabbit presence, including the southern half of The Mesa in the north-central PAPA, the west-central and southern tip of the PAPA, and the south-eastern spur of the Boulder area (Figure 6).

Recommendations

Because this was the first year of survey efforts, insufficient data exists to make management recommendation regarding energy development and pygmy rabbits in the PAPA. Monitoring of pygmy rabbit population trends is necessary to determine if changes in management practices are needed. At this point we are able to make some recommendation regarding the development of an effective monitoring plan for pygmy rabbits in Sublette County.

Quality surveys for pygmy rabbits in the PAPA and Boulder study areas are time consuming and, thus, expensive. Areas where vegetation or soil characteristics appear to be unsuitable for pygmy rabbits should be excluded from monitoring areas. We recommend using vegetation and soil layers (when they become available) to examine areas in the southern half of The Mesa, the west-central and southern tip of the PAPA, and the south-eastern spur of the Boulder area to determine if pygmy rabbit habitat is present in sufficient quantities to warrant monitoring. We found little evidence of pygmy rabbits in these areas, which could indicate that either sufficient habitat is not present or that other factors, such as disturbance, might be excluding pygmy rabbits from these areas. If habitat is not present, these areas could potentially be excluded from future monitoring programs.

In general, both the PAPA and Boulder study areas support pygmy rabbits. A method to quantify activity within each plot, however, is necessary to detect the level of population change outlined in the Wildlife Monitoring and Mitigation Matrix of the ROD. Because pygmy rabbits have a short life expectancy, use multiple burrow complexes, and can have large home ranges, monitoring activity status of individual active burrows in not likely to accurately depict population trends. For example, if a burrow complex is favored by a particular rabbit, it may be active one year. If that rabbit dies and its home range is re-occupied by a rabbit that favors a different set of burrow complexes within that home range the first burrow will cease to be active despite the home range still being occupied. We recommend considering a group of plot-wide indices of rabbit activity, such as the proportion of burrow complexes that are active and the number of available pygmy rabbit burrow complexes present within a plot.

Development of an effective monitoring program for pygmy rabbits at the scale of this project has not yet been attempted. Many challenges, not the least of which is lack of knowledge of pygmy rabbit population dynamics and ecology, make development of such a monitoring plan difficult. However, researchers are continually improving methods to survey for pygmy rabbits and are developing promising indices of abundance. Consultation with key researchers will be essential for developing a truly workable monitoring program for the PAPA. The Wyoming Natural Diversity Database looks forward to working with the PAPO to continue pygmy rabbit survey efforts and to develop an effective pygmy rabbit monitoring program.

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Table 1. Number and percentage of pygmy rabbit survey plots in each activity category (Appendix C). Surveys of known and random locations were conducted Sublette County, Wyoming, in the PAPA (treatment) and Boulder (reference) areas from July-early October 2009. A subset of plots in the PAPA occurred in the oil and gas development zone and was summarized separately (Developed). Total sample sizes for each group (Total *N*) and for each activity category (*n*) are provided.

		Active		Active?[1]		Recent		Recent?[2]		Possible Old[3]		No Evidence[4]	
Area	**Total *N***	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**
PAPA	359	193	**54**	5	**1**	95	**26**	1	**<1**	22	**6**	43	**12**
Known	51	42	**82**	2	**4**	6	**12**	-	**-**	-	**-**	1	**2**
Random	308	151	**49**	3	**1**	89	**29**	1	**<1**	22	**7**	42	**14**
Boulder	85	69	**81**	2	**2**	10	**12**	-	**-**	4	**5**	-	**-**
Known	1	1	**100**	-	**-**	-	**-**	-	**-**	-	**-**	-	**-**
Random	84	68	**81**	2	**2**	10	**12**	-	**-**	4	**5**	-	**-**
Developed	112	59	**52**	2	**2**	28	**25**	1	**1**	9	**8**	13	**12**
Known	32	28	**88**	2	**6**	2	**6**	-	**-**	-	**-**	-	**-**
Random	80	31	**38**	-	**-**	26	**33**	1	**1**	9	**11**	13	**16**

[1] Fresh pellets present could have been either pygmy rabbit or cottontail.

[2] Old pellets present could have been either pygmy rabbit or cottontail.

[3] Burrows present could have been made or used by pygmy rabbits, but no pellets present.

[4] No pellets or possible pygmy rabbit burrows detected.

Figure 1. Map of PAPA (treatment) and Boulder (reference) study areas in Sublette County, Wyoming, surveyed for pygmy rabbits in 2009 by WYNDD. Orange areas within the PAPA represent oil and gas development areas outlined by the BLM.

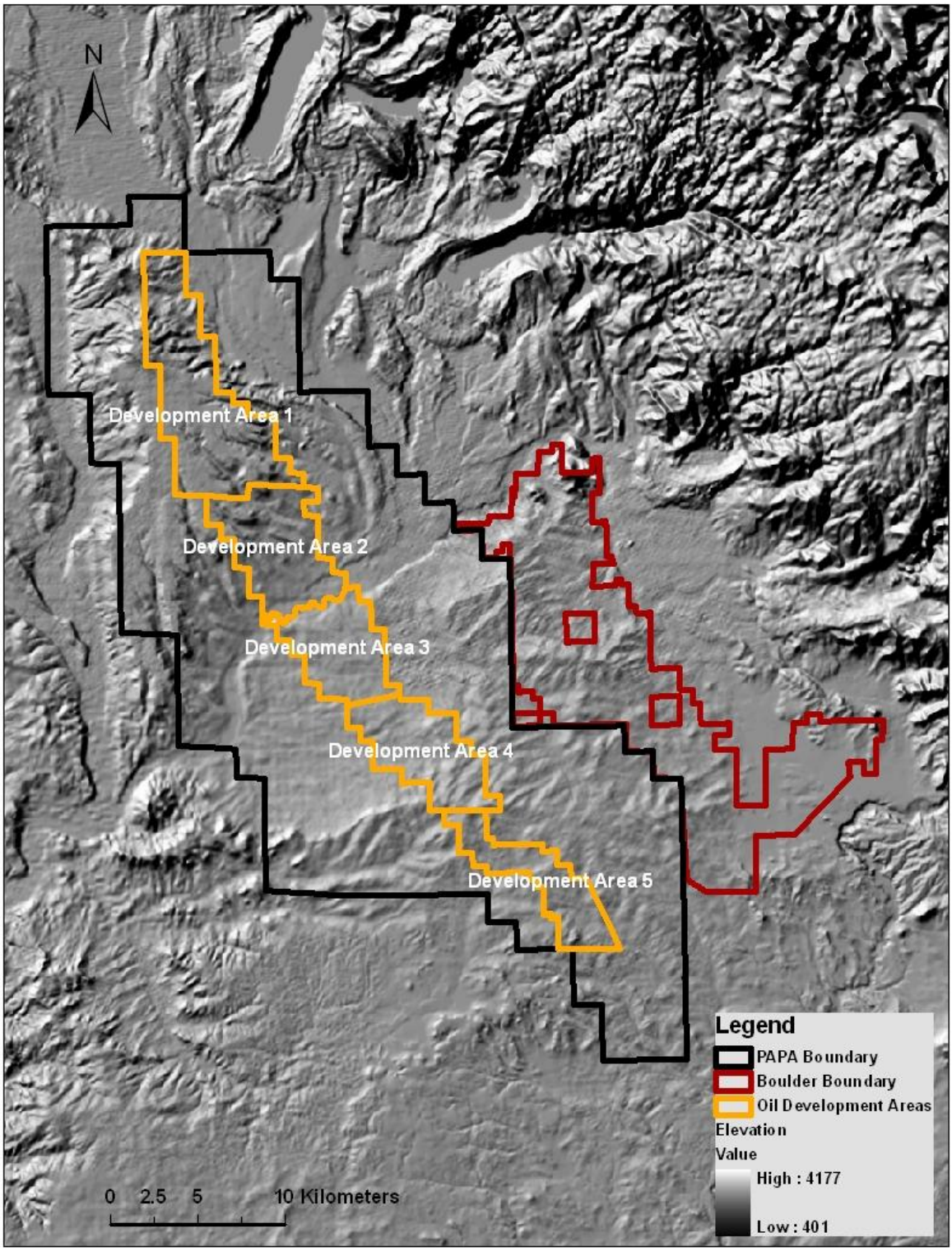


Figure 2. Pygmy rabbit survey results for the PAPA (treatment) and Boulder (reference) study areas. Survey plots (400m x 400m) for known and random locations are color-coded based on activity status (Appendix C). Surveys were conducted in Sublette County, Wyoming, in 2009 by WYNDD.

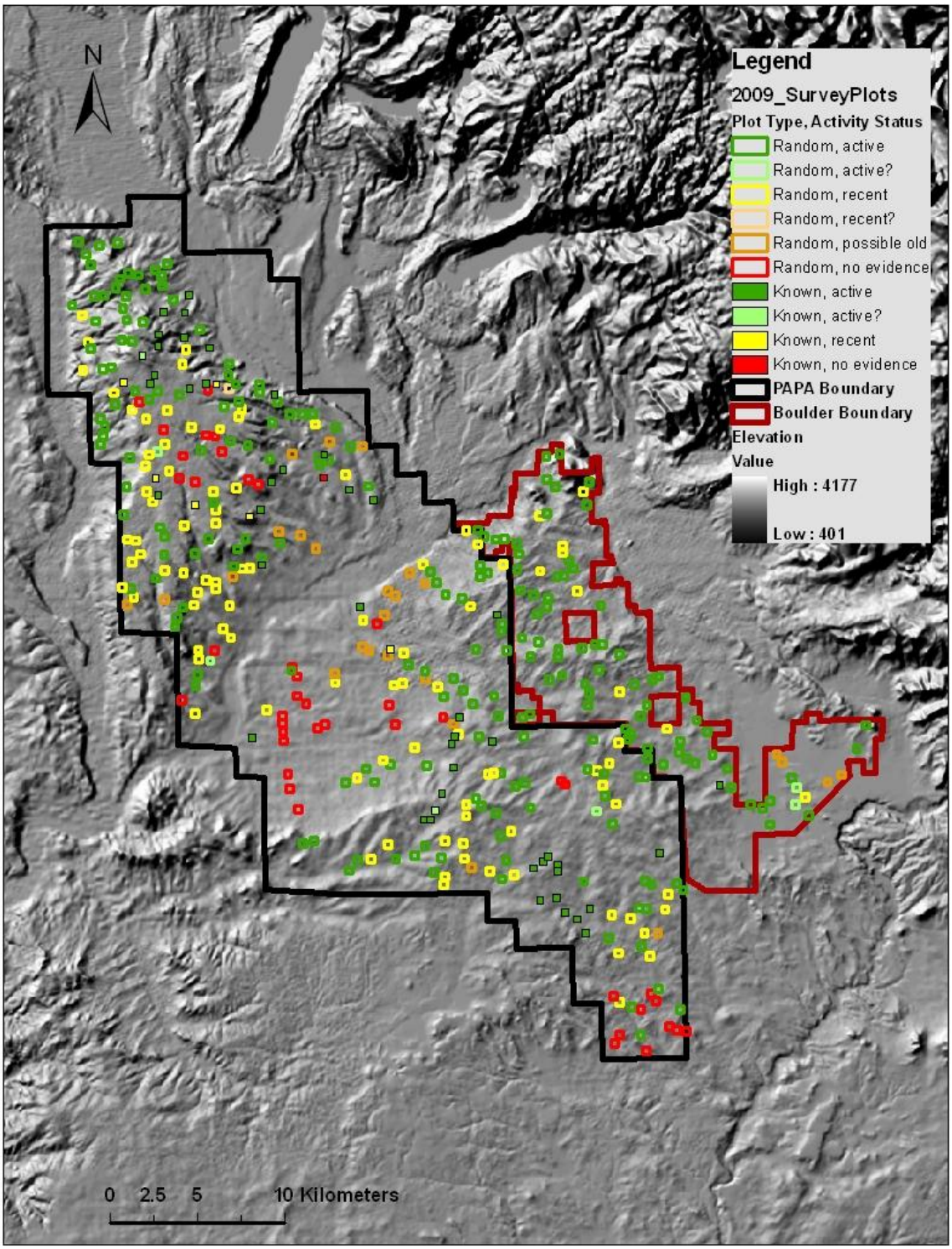


Figure 3. Locations of 124 pygmy rabbits seen in the PAPA (treatment) and Boulder (reference) study areas from July - October 2009. Surveys were conducted in Sublette County, Wyoming, in 2009 by WYNDD.

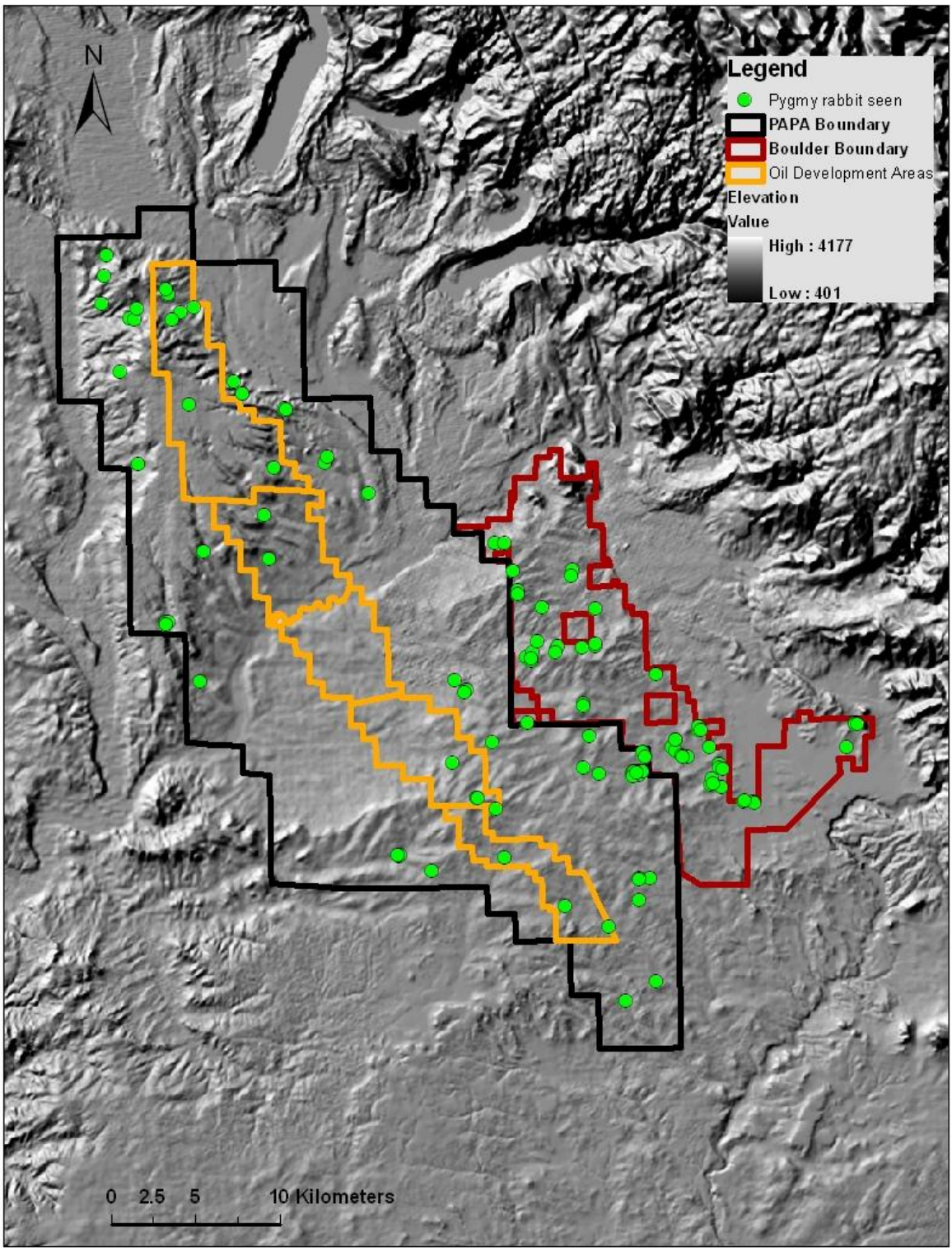
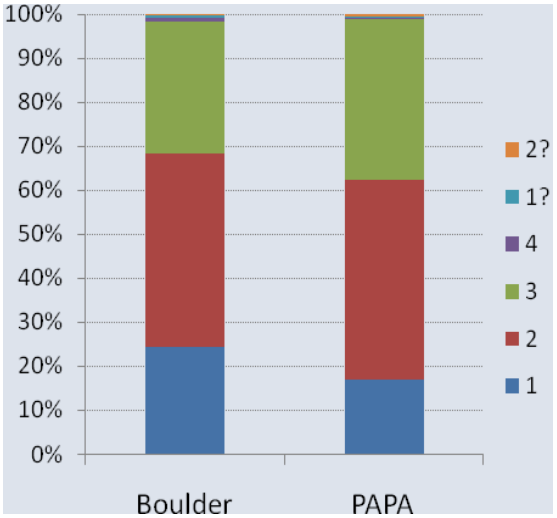
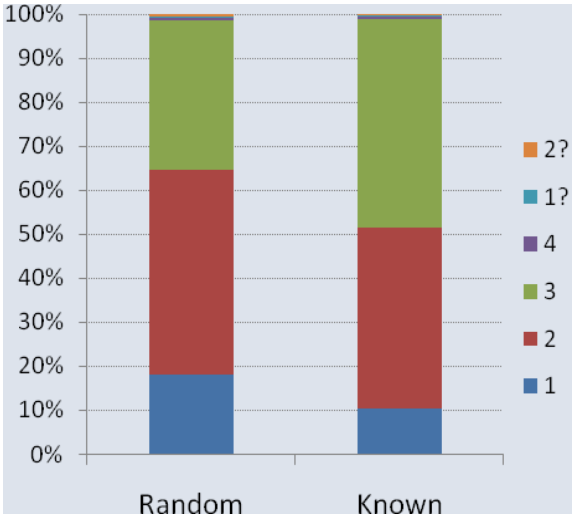


Figure 4. The relative proportion of burrows in each activity category (Appendix C) for a) plots in the Boulder (n = 83) and PAPA (n = 301) study areas, b) random (n = 251) and known (n = 50) plots within the PAPA, and c) plots inside the development zone (DZ) (n = 95) and outside the development zone (n = 206). We used "1?" to indicate when fresh pellets present could have been either pygmy rabbit or cottontail and "2?" to indicate when fresh pellets present could have been either pygmy rabbit or cottontail.

a)



b)



c)

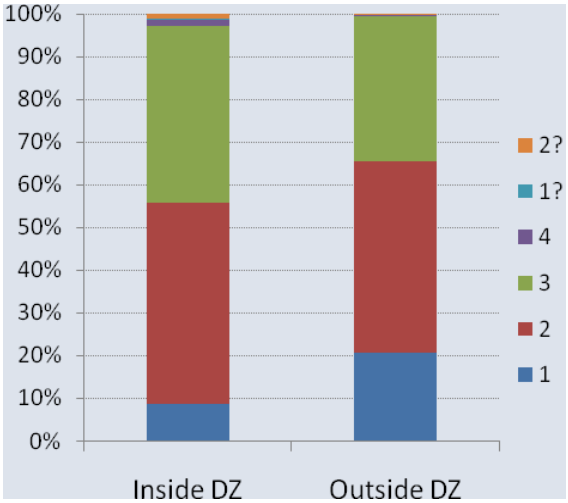


Figure 5. Pygmy rabbit survey results within the oil and gas development zone in the PAPA (treatment) study area. Survey plots (400m x 400m) for known and random locations are color-coded based on activity status (Appendix C). Surveys were conducted in Sublette County, Wyoming, in 2009 by WYNDD.

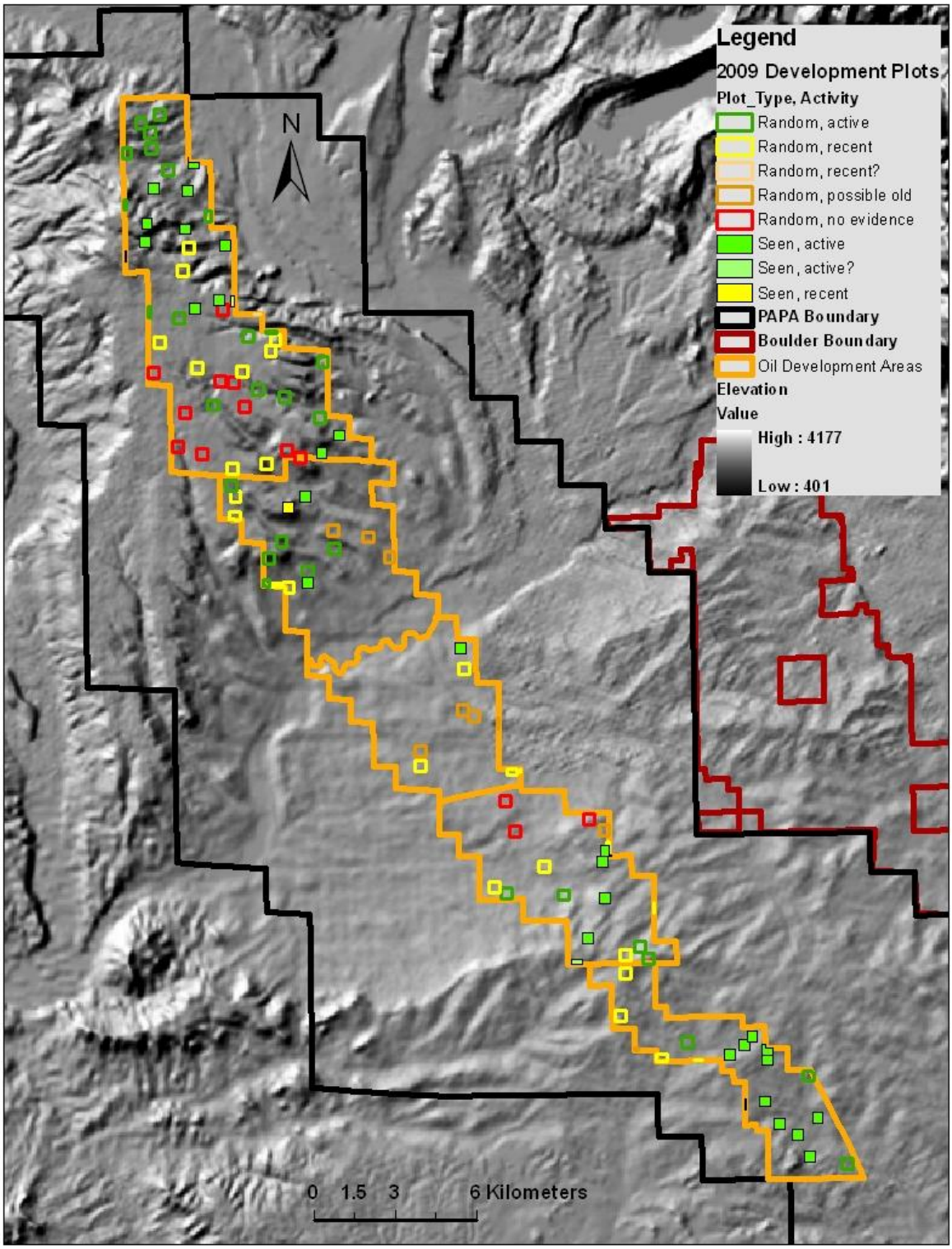
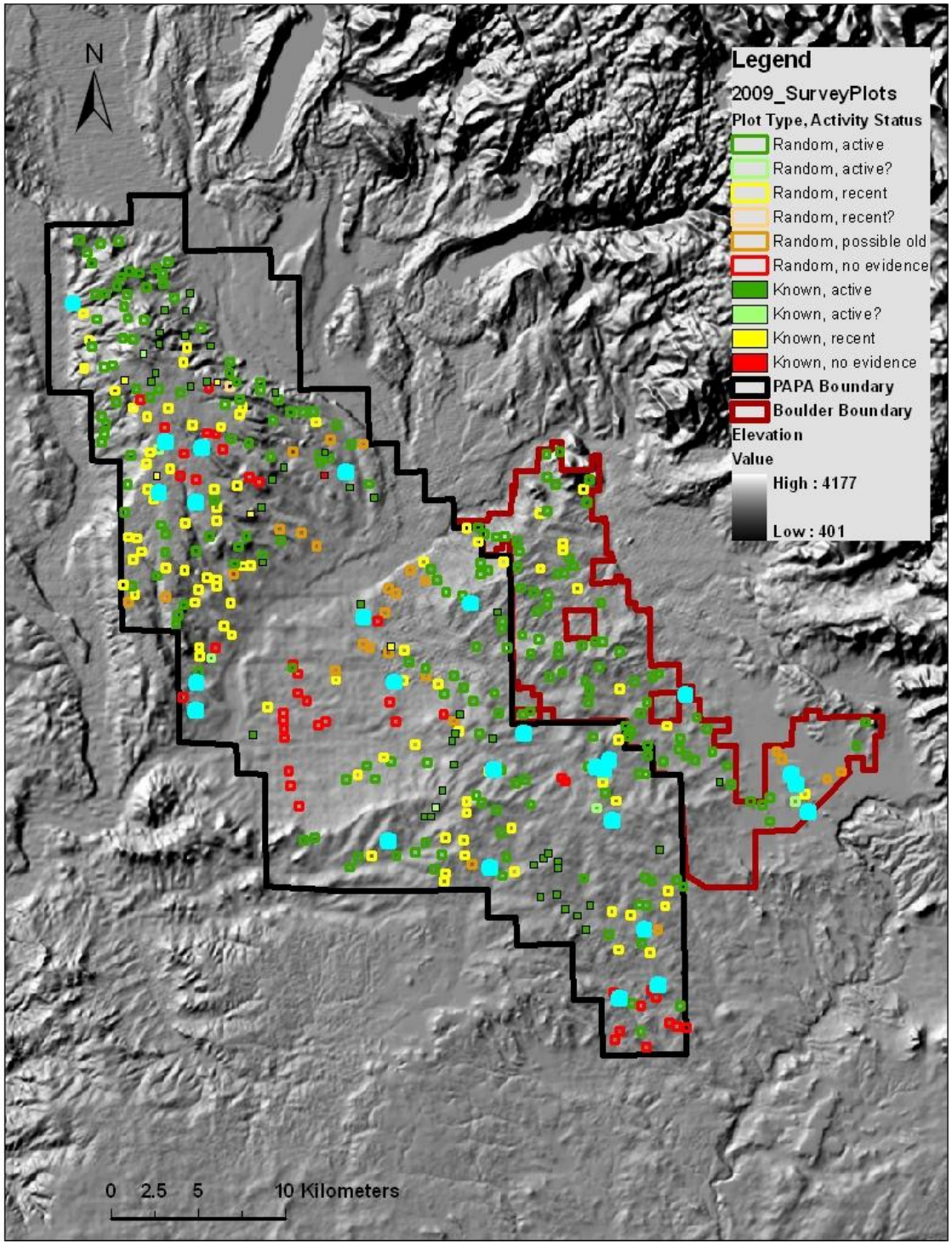


Figure 6. Pygmy rabbit survey plots likely used by rabbits for dispersal rather than residency in the PAPA (treatment) and Boulder (reference) study areas. Plots highlighted in bright blue are locations where only a few fresh or old pygmy rabbit pellets were detected. Surveys were conducted in Sublette County, Wyoming, in 2009 by WYNDD.



APPENDIX A

2009 Pygmy Rabbit Survey Points

771 Total Random Points

Random points cut because they were outside of the study area boundaries

76	309	567
142	344	572
143	345	573
221	462	592
248	463	593
249	507	610
267	506	611
301	539	
308	564	

Random points cut because there were 2 or more points already in a section:

55	151	371
64	192	668
65	282	749
122	292	
123	370	

TOTAL # RANDOM POINTS = 733

75 Known points where rabbits were seen.

23 Known points where rabbits were seen but were incorrectly categorized as no rabbits seen in the BLM database.
Known points from incorrectly categorized dataset that were cut:

- 8, 11, 12 were cut because they were duplicated of 5, 6, 7, respectively.
- 4 was cut because was outside of PAPA
- 10 was cut because coordinates are incorrect and mapped WAY outside the Pinedale FO

TOTAL # KNOWN POINTS (RABBITS PREVIOUSLY SEEN) = 93

31 Active pygmy rabbit locations (rabbit or fresh pellets seen) from Dale Woolwine's 2008 BLM surveys.

- Excluded all survey locations outside of the PAPA and Reference Areas
- Excluded all survey locations where fresh pellets were not seen.
-

TOTAL # DALE WOOLWINE'S ACTIVE PYGMY RABBIT POINTS = 31

TOTAL NUMBER OF PYGMY RABBIT SURVEY LOCATIONS FOR 2009 = 857

APPENDIX B

BLM Protocol

PYGMY RABBIT SURVEY PROTOCOL

This protocol is adapted from:

SURVEYING FOR PYGMY RABBITS (*Brachylagus idahoensis)*

Principal author: Helen Ulmschneider, Boise District, ID BLM
Review and contributions from:
Dave Hays (WA Dept. Fish and Wildlife)
Hadley Roberts (independent wildlife biologist, ID),
Janet Rachlow (Univ. Idaho)
Todd Forbes (BLM, OR)
John Himes (Nevada Dept. Wildlife, now at Texas Parks and Wildlife Dept.)
Eveline Sequin (Univ. Nevada-Reno, NV)
Marcy Haworth (FWS, Reno, NV)
Todd Katzner (Univ. Wyoming, now at Imperial College, London, England)
Adam Kozlowski (Utah Div. Wildlife Resources)
Ryan Rauscher (Montana Fish, Wildlife, and Parks)
Pat Lauridson (CA Dept. Fish and Game)

These survey procedures and data standards may be changed at any time at the discretion of the BLM.

Pygmy rabbits are a BLM Sensitive Species which occur through most of the Great Basin. Although it has been petitioned for listing under the Endangered Species Act, its distribution and population trends are largely unknown. The goal of the broad scale survey described here is primarily to find populations of the rabbit. However, by conducting surveys and recording data in the manner described, locations and a measure of burrow density and "occupancy status" can be obtained at the same time, which can provide a baseline index for population monitoring, and a way to coarsely compare different areas. These surveys will document not only where the rabbits are but also where they are not, which is useful information for refining habitat models, and for land managers.

***A key piece of advice*:** The rabbits themselves are secretive and difficult to see; thus it is being familiar with their habitat and sign that is the key to finding populations. Before surveying, look at pygmy rabbit habitat, burrows and pellets with an experienced person in the field. If possible, also look at badger and ground squirrel diggings, to help you learn to distinguish the differences between their burrows and those of pygmy rabbits. Descriptions and pictures are helpful, but there's no substitute for seeing it in the field.

HABITAT

There are two main features of pygmy rabbit habitat: relatively taller and denser big sagebrush (*Artemisia tridentata)* (but see below) and deep soils.

Sagebrush

Usually burrows are found in the taller and denser big sagebrush in an area. The height of the sagebrush can vary enormously, from about 1 ½ to 7 feet. Density can also vary, but commonly the sagebrush is so dense right at burrows that it is difficult to walk through. This means > 30% cover. The burrows are so hidden under the canopy that they are often only found by lifting the vegetation. Pygmy rabbits also may occupy habitat that does not appear ideal: with short sagebrush and "bad" soil. It is important to keep an open mind, and not develop set ideas about what comprises pygmy rabbit habitat too early, or you may overlook inhabited areas. Regardless of the absolute height of the vegetation, the rabbits will almost always burrow in the tallest and densest sagebrush on the landscape.

Soils

Generally, pygmy rabbits burrow in loamy soils deeper than 20 inches. Soil composition needs to be able to support a burrow system with numerous entrances, but also must be soft enough for digging. A habitat model from the Univ. of Idaho (Rachlow and Svancara 2003) used a clay content of 13 to 30%, but models from Idaho State Univ. (Simons and Laundre 2001) used <13.5 % clay.

At the Landscape Scale

Pygmy rabbits are found in alluvial fans, swales in a rolling landscape, large flat valleys, at the foot of mountains, along creek and drainage bottoms, in basins in the mountains, or other landscape features where soil may have accumulated to greater depths. They are generally on flatter ground, sometimes on moderate slopes, and not on steep ground.

At the Patch Scale

Look for relatively taller, denser big sagebrush (not low sage) and areas where there appears to be a non-uniform distribution of sage, in other words, where the texture of the sagebrush stand is uneven, or "lumpy", in both height and density. When scanning across a valley these clumps stand out as taller, or as having a different color. It is fairly effective to go directly to these areas to begin a search. Also look for signs of digging, and for soil surface that is not flat and level. The rabbits tend to mound up the soil where they have been burrowing over the years. Drainage bottoms and sagebrush draws with a relatively uniform coverage of sagebrush are also often used by pygmy rabbits.

PYGMY RABBIT SIGN

No other animal digs burrows with the combination of features of those of the pygmy rabbit:

- In tall dense sagebrush habitat,
- Burrow entrance 5-7 inches average diameter,
- Located under sagebrush,
- A number of burrow systems in an area, and small round pellets.
- A burrow system with a carpet of small rabbit pellets around it is diagnostic of pygmy rabbits.

Burrows

- Burrow entrances range from 4-10 inches across, usually round but may be slightly wider than tall. The size of pygmy rabbit burrows usually surprises biologists the first time they see them because the holes are larger than they would have thought; many would have identified them as badger burrows. The older a burrow, the more the entrance seems to get enlarged, possibly from predators digging.
- Burrows are most often placed right at the base of sagebrush, or occasionally another shrub species. Sometimes an entrance will be more in the open, but the majority of entrances will be underneath sage.
- At burrows, usually you will find the sagebrush so dense that walking is difficult, and you have to thread your way through it (which means >30% canopy cover). In more open sagebrush where you can walk more freely, you will probably not find burrows.
- The opening of the burrow usually flares out, and there may be a large pile of dirt outside the entrance, 1 to 3 feet in diameter.
- Usually, there will be more than one entrance in a burrow system; 2-4 is most common, with a maximum of up to 12, and occasionally there is only one.
- The burrow can slope down very steeply or moderately, and the burrow often narrows down from the flared entrance to about 4-5 inches in diameter.
- Burrow systems will rarely be isolated; there will be a number of them in a habitat area. Isolated burrows without pellets are difficult to identify with certainty.
- A key feature of pygmy rabbit burrow systems is that they show evidence of having been built up and used over many years, unlike ground squirrel or badger diggings, which are generally a one-time affair. Pygmy rabbits remodel in the same spot year after year, creating mounded areas with taller, denser sagebrush growing on the old dirt piles, and evidence of burying the lower stem of nearby sagebrush over time. The undug areas between these mounded areas will have a fairly level ground surface (observation from Dana Quinney, expert on badger and ground squirrel diggings, Idaho Army National Guard).
- Sagebrush grows taller and denser on the mounded dirt. As pygmy rabbits 'remodel' over the years, filling in one tunnel and digging new ones within the same burrow system, they create overlapping mounds of varying ages in one area. The resulting complex of mounded area may be 15 to 30 ft in diameter. Thus, pygmy rabbit burrow areas have old mounding with plants and shrubs growing on them in addition to the current fresh dirt piles.

Pellets

- Pygmy rabbit pellets are the smallest of the rabbit pellets, averaging 4-6 mm in diameter. However, the size can vary.
- Pellets are in little groupings near the burrow entrance and under sagebrush nearby. At an active burrow, there will often be a carpet of evenly-sized small pellets. Large quantities of uniformly small pellets around a burrow entrance are diagnostic of pygmy rabbits.
- Mountain cottontail pellets average 6-10 mm, but can be smaller. It appears that younger, smaller cottontails produce smaller pellets. Thus, they can overlap in size with pygmy rabbit pellets, creating potential for confusion. Be cautious.

- Cottontails may use some of the same areas as pygmy rabbits, and may use their burrows. Beware particularly if there are rocky outcrops nearby
- Full-grown whitetail jackrabbit scat is 11-12 mm in diameter; blacktail jackrabbit pellets are about 9-10 mm in diameter.
- Rodents, including ground squirrels, have oblong droppings.
- Recent rabbit pellets are usually a dark to medium brown to greenish or blackish color. Very fresh pellets have sheen or appear glossy. Older pellets appear dull and weather to gray. If the rabbits have been eating dry grass, fresh pellets may be tanner and a little larger. If rabbits have been eating green wet feed in the spring, the pellets can be almost black on the outside, green on the inside, and may be more elongated and have little pinched ends, being softer when they were deposited.
- We don't know how long pellets last or how long they take to turn grey. Weather conditions affect how fast they turn grey; dry pellets will stay brown, wet pellets will turn grey faster. Pellets under winter snow may stay very fresh looking until uncovered the next spring. Some ants collect the pellets, so if you find burrows and no pellets, it may be due to ants.

Other Species Burrows

- A key difference between pygmy rabbit and badger or ground squirrel burrows is that badger and ground squirrel burrows generally do not create large complex mounds of overlapping dirt piles.

ARE THEY PYGMY RABBIT BURROWS??

It is the combination of all indicators that you need to consider, both of the burrow itself, pellets, and the pattern of burrows on the landscape.

1. First, you need to find both burrows and pellets together.
2. For burrows that appear characteristic of pygmy rabbits but have no pellets, search further in the area, and/or look at another time of year. If you find other burrows with pygmy rabbit pellets in the area, then you can conclude that other, similar burrows without pellets are also from pygmy rabbits. Old burrows may tell us something about changes in population extent or density and are also important to map.
3. There should be a number of burrow systems in an area, within a habitat patch.
4. Is it the right habitat – big sagebrush and deep soils?
5. Are the burrows placed underneath sage? Are they the right size and shape?
6. What other animals are around? Be aware there may be cottontails and perhaps young jackrabbits producing small pellets similar in size to pygmy rabbit pellets, or ground squirrels, badgers, or other burrowers to sort out.
7. Cottontails and ground squirrels may use burrows originally dug by pygmy rabbits, and further confuse the issue. However, of the rabbits, only pygmy rabbits actually dig burrows. We are interested in burrows dug originally by pygmy rabbits, even if they are now occupied by another animal.
8. Finally, you can use other methods (discussed at the end of this paper) to confirm presence of pygmy rabbits.

Sign in Snow

During winter, pygmy rabbit tracks and pellets in the snow can be more obvious than other times of the year. Pygmy rabbit tracks can generally be distinguished from other rabbits by the size of the hind foot (Table 1). During winter, juvenile cottontails are nearly the same size as adults, which should minimize overlap in track size between the species.

Table 1. Rabbit track sizes, from information in Forrest 1988, Green and Flinders 1980, and Katzner 1994.

	Pygmy Rabbit		**Cottontail**		**Jackrabbit**	
Back foot length	1.8-2.5 in	46-71 mm	3-3.5 in	77-90 mm	3.5 -4 in	90-103 mm
One track set (4 feet)	6-8 in		6.5-11 in		10-30 in	
Between track sets	6-16 in		8-22 in		10-60 in	

Both Rauscher and Katzner (pers. comm.) have observed that pygmy rabbits traveling in fresh snow will re-use the same tracks, leaping from spot to spot a few inches apart (launching-and-landing sites), and leaving a diagnostic pattern. As the rabbits use those sites for several days, the launching-and-landing sites get larger and larger and eventually become a continuous trail. Other rabbit species do not create this initial stage of re-used launching-and-landing sites. Over time, in older snow, pygmy rabbits create a complex maze of continuous trails between burrows (Ulmschneider, pers. obs.).

It can be quite effective and efficient to drive two-track roads in sagebrush areas a day or two after a light snow, looking for launching and landing sites, measuring rabbit tracks, and following weasel or other predator tracks to locate pygmy rabbits (Rauscher, Katzner pers. comm.). To find burrows, it can also be useful to look where snow on a sagebrush forms an umbrella with a cave underneath. Rabbits often use these areas and pellets and tracks will be found underneath. (Sequin, pers. comm.). In the snow, active burrows will be obvious with tracks leading into and out from the entrances.

ORGANIZING AND CONDUCTING SURVEYS

TARGETING HABITAT

Pygmy rabbits are not randomly distributed within the sagebrush landscape, they are patchily distributed, because they choose particular soils and sagebrush habitats, and they do not appear to be abundant in many situations. It is necessary to first target habitat as best you can, that is, to sort out the most likely habitat. We describe below a several-stage approach to doing this, using aerial photos, soil and vegetation maps, Geographic Information Systems (GIS, if

available), field knowledge, and driving and walking in the field as the final step to target where to look for pygmy rabbits.

1. ***Landscape Scale***

The most basic components to use in a GIS model or other map are sagebrush types overlaid on soils (composition and depth). One kind of area to target for surveys is regions where big and low sagebrush are intermingled. Some models have added slope, aspect, fire history, and elevation, but these would be secondary parameters after first delineating sagebrush types and soils.

2. ***Mid-scale***

Examine aerial photos, topographic maps, and use local knowledge to add or delete areas from your initial map. It is usually possible to distinguish dense sagebrush or to see mounds of taller, denser sagebrush as a dotted or mottled pattern on aerial photos. You could combine surveys for sage grouse or big game with surveys for pygmy rabbit habitat.

Rank the areas you identified at the large scale, and start surveys in the most likely areas. These would be the largest blocks on the sagebrush and soils map which weren't eliminated by your refinements, areas surrounding past records, areas where aerial photos show mounds of sagebrush as a dotted pattern (see example photo at end), where big and low sagebrush are interspersed, and where there are swales of deep soils and tall dense sage.

3. ***Fine scale***

While you are driving to or in a chosen area, look for dense tall sage, especially with a "lumpy" or uneven texture, as well as for signs of digging. When a suitable area is spotted, stop and walk a survey route.

Your sampling scheme will be dictated by your particular circumstances, both by how the potential habitat is distributed and by your "person-power". Your planned survey intensity for each area will vary with its priority, the size of the area you want to survey, and the people available to do it. Depending on travel time and whether you are finding burrows, (which will slow you down), you might expect to complete about 3 to 7 miles of walking transects in a day. Conduct the greatest amount of sampling in high priority areas, less sampling in lower priority areas. Portion your survey efforts among your highest priorities, with some sampling in lower priority habitat also, as a check on your ability to target habitat.

4. ***Patch scale***

While you are walking a survey route you should target the tallest, densest patches of sage. These patches look like islands that stand out above the rest.

SURVEY ROUTES

The goal of a survey route is to check enough habitat in an efficient manner to determine whether pygmy rabbits are present or not, and secondarily to get an index of density of burrows. The goal is not to map out the total patch of habitat or to map every burrow within the habitat. Walk a meandering line through a habitat patch, targeting the most likely looking places (instead

of the edge), and then continue on to the next swale or habitat patch, or loop back the other side of the valley. If you map your route and record results well, especially if you use a GPS unit, your survey route will be repeatable.

Recording burrow system locations is a more complete record for those who come after you and want to repeat your work to determine changes over time – they will know exactly what you found where.

If you are alone, walk in a loop or triangle, targeting patches of taller, denser sage, looking for pygmy rabbit burrows and pellets. The goal of a looping or triangular route is to survey during all your walking time, and to avoid walking without actually surveying. Using a topo map, you should be able to design a route that takes you up one swale and down another, or up and down two sides of a valley. In patchy habitat and where patches are small and follow the contours of the land, following the landforms and targeting the taller sagebrush clumps will be most effective. This means your survey line will be meandering, not straight.

If the habitat is uniform or on extensive flats, straight transect lines arranged in a triangle, or a spiral pattern may be appropriate. For a spiral transect, walk directly to the center of a large, dense sagebrush patch, and then spiral your way out, gradually increasing the diameter of your circle until the habitat is no longer appropriate. To fully check out a potential site often takes about one hour of survey time (Eveline Sequin, pers. comm.).

Transect length should be dictated by the extent of the habitat patch, road distribution, and the amount of overall habitat you have identified to cover.

When you drive through unsuitable looking habitat within a generally potential habitat area, stop occasionally and walk a short survey route, as a check on your judgment of habitat, and record your transect walked. *Note why the habitat looks unsuitable.

AREA SEARCH FOR RABBITS

When you find several current burrows take about a half hour to search the area looking for pygmy rabbits. This will help confirm whether you have pygmy rabbits, and will help you gain confidence in your ability to distinguish pygmy rabbit sign. Walk slowly, in widening circles around the active sites, looking ahead. Rabbits will often slip quietly into the burrow as you approach, and you have to be alert for the slight movement. Once you learn how to look for the actual animal, you will begin to see them more (Dave Hays, pers com.).

Pygmy rabbits are easy to distinguish from mountain cottontails. When running away, the white of a mountain cottontail tail is usually visible. Pygmy rabbits do not have any white on their tail. Also, pygmy rabbits seldom run as far as mountain cottontails. Pygmy rabbits will scamper a short distance and stop, often under sagebrush plant or near a burrow entrance.

SEASONAL CONSIDERATIONS

During late summer and early fall pellets can be scarce at burrows. Burrow complexes that had lots of sign in winter or spring may appear almost deserted in late summer, with few pellets present, and then appear repopulated later. Pygmy rabbits may use burrows less in summer and fall. They may abandon their burrows at that time of year in favor of dense cover, perhaps due to parasites.

Winter may be a better time of year to confirm rabbit presence than the summer and fall. After a fresh light snow, fresh tracks and fresh pellets are obvious. Also, rabbits clean out

burrow entrances after a snow, which helps identify occupied burrows. Pygmy tracks can often be followed to a burrow entrance. Winter logistics can become difficult, though, as snow deepens. Additionally, rabbits begin to burrow under the snow as it deepens, and you may not see much sign on the surface.

When initial surveys are conducted in the summer, and if you find possible or "old" pygmy rabbit sign, plan to return in late fall or winter and check again. For monitoring known populations, the time of the year should be consistent.

RECORDING DATA

In every report submitted, the completed pygmy rabbit survey summary form is required. If there is sign or sighting, an excel file is required (with all of the attributes listed completed, and in the order that they are listed) or shapefile from a GPS that used a data dictionary. If there is no sign or sighting, an excel file with the pygmy rabbit sign/sighting attributes is not required.

BURROW CLASSIFICATION: (See survey key for more details)

Fresh pellets: brown pellets near a burrow.
Active burrow: at least one entrance open, without cobwebs or debris that shows lack of use, usually shows a trail. In snow, tracks and/or pellets visible.
Inactive burrow: burrow entrances have cobwebs, grass seeds, or other debris in entrance.
Old pellets: only grey pellets at a burrow.
Collapsed burrow (Col): self explanatory
Predator digging at a burrow: Digging may have been by a predator such as coyote or badger. If it was a predator, it was most likely digging after prey, and the prey may have been pygmy rabbit.
Possible PR burrow (Poss): Burrow seems right for pygmy rabbit, but there are confusing pellets or no pellets, or it is not in association with other pygmy rabbit burrows (identified by pellets or sightings).

WAYS TO RECORD DATA:

GPS unit with a data dictionary (e.g., GeoExplorer):

1. Record your pygmy rabbit point (i.e., a burrow system).
2. Record each pygmy rabbit burrow system (not individual openings) as a point feature, using a pygmy rabbit data dictionary that includes the essential information on the data form at the end of this paper. Burrow systems may be about 15 ft across. In areas with dense burrows, it may be difficult to decide when to record a new burrow system. One rule of thumb is to record a new burrow system at least 30 ft apart (however they can be much denser than that; in Montana, Rauscher [1997] found an area with 8 burrow systems within 30 m).
3. Take daily field notes of where you surveyed for the day, habitat, numbers of burrows in each status category, extent of habitat, why you thought they were or weren't from pygmy rabbits, general findings (no sign, old sign, lots of current sign, other critters), any other notes that would help someone else determine where you looked, what you found,

and the validity of what you found. Remember that it is possible to lose GPS data, and that general notes are often extremely useful in interpreting the data! Remember zeroes are important to record and discuss!

4. Map your survey areas on a topographic map or aerial photo, with date, your name, and a key to any symbols used (or GIS map).
5. When finding pygmy rabbit sign in a new area, take samples of droppings and label each container with date, location, and your name (film canisters work well, or plastic zip bags).
6. Take photos of burrows, landscape setting, and any other sign (tracks, trails, bones, pellets). Label your photos with date, location (Township, Range, Section and ¼ sections), your name, and what it shows.
7. Also mark your driving routes on the maps, when you are within a search area and looking for target habitat to do foot surveys.

GPS unit without a data dictionary:

1. Record your survey route using a line feature and pygmy rabbit burrow systems using a point feature, as above.
2. Use the paper data form (see below) to record the necessary information.
3. Collect pellets and take photos as above.
4. Complete the associated excel spreadsheet with field data and UTMs or shapefile name of features.

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APPENDIX C

Burrow Activity Status Classification Template

Criteria	Active (1)	Recent (2)	Possible Old (3)	Possible Very Old (4)
Burrow Entrance:				
Intact/Open	X	X	X	
Intact/Debris			X	
Collapsed				X
Rabbit Sign:				
Fecal Pellets				
Fresh	X			
Old or Weathered		X		
Absent			X	X
Digging				
Fresh or Abundant	X			
Absent, Old, or Few		X	X	X

APPENDIX D: Pygmy Rabbit Field Survey Datasheet

Survey Date:_____ Observers Names:_____ Affiliation:_____

Plot #:_____ Location: PAPA / Boulder Reference Data Correction: Realtime

Ownership: BLM Pinedale / State / Private Survey Method: Foot / Horse / Incidental GPS Unit #:_____ Camera #:_____

UTM Easting	UTM Northing	Waypoint #	# Pygmy Rabbits Seen	Burrow Complex Details (Check as many as apply)										# Entrances	Pellet Quantity (H,M,or F)		Soil	Canopy Cover				Burrow Category (1,2,3,or 4)	Comments
				T- Clean Trail	O – Open	COL – Collapsed	DEB – Debris filled	DIG – Fresh Digging	B – Base of Bush	R – Base of Rock	E – Enlarged by pred.	TS – Tracked Snow	US – Untracked Snow		FRESH	OLD		SHRUB	FORBS	GRASS	BARE		

Northing: START _____ END_____

Easting: _____ _____ _____ _____ _____ _____ _____ _____ _____

*BEFORE YOU START: Record waypoint name & UTM's of SW corner of plot. Add 50m to Easting and record at base of next vertical line to the right. Repeat across bottom. Add 400m to Northing and record at top.